Bugs in the Bottle, Resin in the Jar: From Antiquity's Pharmacological Wines to Modern Novelty Spirits

Douglas C. Youvan

doug@youvan.com

www.youvan.ai

December 30, 2025

Across cultures, humans have long treated alcohol as more than a drink: it is a solvent, a preservative, a carrier of meaning, and a compact "container" for medicine, ritual, and spectacle. This paper traces a single instinct across millennia: the urge to add "something extra" to alcohol, from resins and herbs in ancient wine jars to snakes, insects, and other creatures in contemporary novelty bottles. While modern consumers often encounter these additions as curiosities (a worm in mezcal, a scorpion in a souvenir tequila), the deeper lineage is older and more serious: alcohol's ability to extract plant compounds, slow spoilage, and stabilize preparations made it a natural platform for pharmacology and symbolic practice. The paper distinguishes three overlapping motives that recur across time: functional preservation (resin, botanicals), therapeutic or aphrodisiac claims (medicinal wines, animal infusions), and visible proof-of-story (the object in the bottle as performance and brand). By separating chemistry from folklore and tradition from marketing, we gain a clearer vocabulary for what these practices are, why they persist, and how "weird combinations" became a durable human pattern rather than a modern gimmick.

Keywords: infused spirits, infused wine, maceration, resin wine, retsina, ancient pharmacology, medicinal wines, novelty bottles, mezcal worm, maguey worm, insect larvae, snake wine, fermentation risk, stabilization, spoilage microbiology, cultural symbolism, food history, ethnobotany, alcohol as solvent, authenticity signaling.

A collaboration with GPT-5.2-Thinking. 50 pages. CC4.0.

Outline

1. Framing the Question: “Weird Combinations” Are a Human Constant
1.1 Alcohol as solvent, preservative, and narrative container
1.2 Three motives: function, medicine, spectacle
1.3 What counts as “added”: during fermentation, during maceration, or in the bottle

2. Terminology and Taxonomy
2.1 Infusion, maceration, co-fermentation, and bottle inclusion
2.2 Visible inclusions versus invisible additives (resins, herbs, sugars)
2.3 Insects versus arthropods versus animals: classification matters
2.4 “Wine,” “flavored wine,” and “spirit”: why legal labels diverge from folk usage

3. Antiquity: The Functional Origins
3.1 Resin in wine: preservation-first logic
3.2 Herbal and spiced wines: early extraction and dosing instincts
3.3 Container technology and spoilage: why additives made practical sense
3.4 From household practice to trade good: standardization pressures in early markets

4. Antiquity: Medicinal and Aphrodisiac Preparations
4.1 Alcohol as delivery mechanism for botanicals and animal-derived materials
4.2 Safety and toxicity: when “medicine” becomes hazard
4.3 Social authority: healer knowledge, priestly knowledge, and the credibility problem
4.4 Ritual entanglement: offerings, symbols, and sacred associations

5. The Long Bridge: Medieval and Early Modern Continuities
5.1 Apotheken traditions: cordials, bitters, and medicated spirits
5.2 Colonial exchange: new plants, new claims, new blends
5.3 The rise of distillation culture: shifting from wine additives to spirit infusions
5.4 The persistence of proof objects: “see it to believe it” as authenticity signaling

6. Modern Era: The “Bug in the Bottle” Cluster
6.1 The mezcal worm: what it is, and how it became a story
6.2 Ants and other insects in or alongside spirits: flavor versus theater
6.3 Scorpions, snakes, and other non-insect inclusions: category confusion as marketing fuel
6.4 Souvenir economics: novelty packaging and the tourist gaze

7. Chemistry and Microbiology: Why Professionals Usually Avoid Whole Additions in Bottle
7.1 Residual sugar and refermentation: pressure, fizz, instability
7.2 Wild microbes and spoilage pathways
7.3 Pectin haze, sediment, and texture drift over time
7.4 Stabilization methods and their tradeoffs
7.5 Sensory reality: what you gain in flavor versus what you gain in story

8. Culture, Meaning, and the Object as Evidence
8.1 The inclusion as a credibility token: “this is real” cues
8.2 Ritual residue in modern products: how old logic gets repackaged
8.3 Authenticity wars: craft identity versus mass-market mimicry
8.4 Disgust, fascination, and status: why some buyers seek boundary-testing drinks

9. Home Experimentation: A Responsible Framework
9.1 Risk categories: low, medium, high (by alcohol type and additive type)
9.2 Safer paths: infuse then filter, control sugar, control microbes
9.3 When not to do it: vulnerable storage, unknown sourcing, long aging expectations
9.4 Documentation and repeatability: turning “weird” into method instead of accident

10. Conclusion: A Single Pattern with Three Faces
10.1 Thesis restated: preservation, pharmacopeia, and performance are the recurring drivers
10.2 What changes: technology, markets, regulation, and branding
10.3 What persists: alcohol as extraction medium and meaning medium
10.4 Forward work: a disciplined Reference section and a comparative case-table appendix

References
Art

1. Framing the Question: “Weird Combinations” Are a Human Constant

At first glance, the modern “bug in the bottle” looks like a late-capitalist prank: a worm in mezcal, a scorpion in a clear spirit, a jar with a snake coiled inside like a museum specimen. But the deeper pattern is not new. People have been adding “something extra” to alcohol for as long as alcoholic liquids have been stored, moved, traded, and made to serve purposes beyond ordinary drinking. The point of this section is to set a disciplined frame: to treat these combinations not as random eccentricities but as a persistent human strategy that keeps reappearing under different technological and cultural conditions.

The constant is not the specific object (worm, herb, resin, fruit, reptile) but the role alcohol plays. Alcohol invites additions because it is unusually good at three things at once: it can pull molecules out of plants and animal tissues, it can slow or reshape spoilage processes, and it can carry meaning. The same liquid can be a drink, a medicine, a preservative medium, and an artifact that proves a story. That versatility is why the practice survives. The details change—containers improve, laws tighten, markets globalize—but the impulse remains stable.

This paper uses “weird combinations” as a deliberately broad umbrella, but it will not treat everything as equivalent. There are real distinctions among adding resin to keep wine from turning, adding botanicals to create a controlled pharmacological effect, and adding a creature primarily to create spectacle or authenticity theater. The goal is not to moralize about any of these motives; the goal is to separate them cleanly so that the reader can see how the same practice can be practical in one era and performative in another—sometimes both at the same time.

1.1 Alcohol as solvent, preservative, and narrative container

Alcohol’s chemical behavior makes it unusually friendly to “addition.” Even modest concentrations of ethanol dissolve and extract compounds that water alone does not readily pull: aromatic oils, resins, many bitter principles, many alkaloids, and a wide range of hydrophobic flavor molecules. This is why a sprig of herb behaves differently in spirits than in water, why citrus peel blooms in gin but can taste flat in tea, and why resins historically mattered in wines transported and stored without modern sealing. In short, alcohol is a portable extraction lab.

Alcohol is also a preservative, but in a subtler way than people often imagine. Very high proof spirits can be strongly antimicrobial, but “preservation” in the historical record is frequently about shifting the ecology, not sterilizing it. A sealed amphora, jar, or bottle creates a controlled microenvironment: oxygen is limited, microbial competition changes, and added substances can inhibit some organisms while encouraging others. Add resin, and you may reduce oxidation and inhibit certain spoilage pathways. Add certain herbs, and you may introduce antimicrobial

compounds. Add fruit, and you may introduce sugar, wild yeast, and pectin that push the system in the opposite direction. The point is that alcohol lets people shape stability, sometimes intentionally, sometimes by tradition, sometimes by trial and error.

Then there is the third role: alcohol as narrative container. A bottle is not only a vessel for liquid; it is a display case for meaning. This is where "weird combinations" become culturally durable. The inclusion can function like an emblem: "this comes from agave," "this is medicinal," "this is brave," "this is exotic," "this is authentic," "this is forbidden." The object inside the bottle becomes a witness. It testifies—whether truthfully or theatrically—that something specific happened in production, that something old is being preserved, or that the drink belongs to a tradition the buyer wants to touch.

That narrative role is powerful enough that it can survive even when the chemistry is irrelevant. A scorpion in a clear spirit does not need to improve flavor to succeed; it only needs to make the bottle unmistakable. In the modern marketplace, distinctiveness is a kind of function. That is not a moral judgment; it is a descriptive claim about why this practice has not died out.

So the core proposition is simple: alcohol is not merely a beverage; it is a multifunction medium. Because it extracts, preserves (or at least modulates decay), and carries story, it naturally invites additions. Once you understand alcohol that way, the long history of "weird combinations" stops being surprising and starts looking like an obvious human pattern.

1.2 Three motives: function, medicine, spectacle

To keep the discussion disciplined, this paper treats most additions as belonging to one of three motives, with the understanding that real-world examples often combine them.

The first motive is function: preservation, stabilization, transport, and sensory management. In early storage and trade contexts, the world was hostile to wine: oxidation, leakage, variable sealing, microbial spoilage, and heat swings could ruin a batch. Functional additions are what you do when your goal is to keep alcohol drinkable, consistent, or economically valuable. Resin belongs here historically, as do some spicing practices that served both flavor and stability. In functional mode, the "added thing" is not a gimmick; it is a technology.

The second motive is medicine: alcohol used as a carrier for therapeutics, tonics, aphrodisiacs, and ritual-pharmacological hybrids. This is an enormous historical domain. Once a society notices that alcohol extracts and preserves plant actives, alcohol becomes the obvious vehicle for "dosing" botanicals and other materials. This motive differs from function because the goal is not the stability of the drink but the effect on the body or spirit—sometimes framed in physiological terms, sometimes in metaphysical ones. In medicine mode, the "added thing" is not primarily about taste, though taste can signal potency and tradition.

The third motive is spectacle: the bottle as performance, the object as proof, the product as dare. Spectacle includes tourist novelty, brand differentiation, and the deliberate courting of disgust or fascination. But spectacle is not only modern. Many traditions have long used visible tokens and dramatic preparations to certify identity, to create boundary markers, or to declare that a product is "strong" in a social sense. Spectacle is what happens when the object is included not because it helps the liquid, but because it helps the story.

These motives are not mutually exclusive. A resin might begin as functional and become traditional flavor. A medicinal infusion can also be spectacle if the ingredients are rare, dangerous, or exotic. A novelty bottle may borrow medicinal rhetoric to sound ancient. The analytical advantage of the triad is that it prevents a lazy flattening of the entire phenomenon into "weirdness." It gives the reader a way to classify examples without moralizing: what is the primary driver, and what secondary drivers are being recruited?

This triad also anticipates a key point later in the paper: modern regulation and modern manufacturing push producers toward spectacle because functional and medicinal claims are more constrained by law, safety standards, and consistency requirements. As a result, the modern market often retains the visible token but loses the practical or therapeutic rationale that originally made additions sensible.

1.3 What counts as "added": during fermentation, during maceration, or in the bottle

If we are going to compare practices across time, we need to be precise about when the "addition" happens. The timing determines the chemistry, the microbial risks, the stability, and often the meaning.

The first timing is during fermentation. Here, fruit, herbs, resins, or other materials are introduced while yeast is converting sugar into ethanol. This is the oldest and most common pathway for many traditional beverages because it is operationally simple: you throw ingredients into the fermenting vessel and let transformation do the work. When additions occur during fermentation, they are subject to yeast metabolism, heat, CO_2 bubbling, and changing pH. Aromatics can be blown off, sugars can be consumed, and plant compounds can transform. Fermentation-time additions often yield deeper integration: the "added thing" becomes part of the beverage's identity rather than a surface note. But they also carry risk: unwanted microbes can enter, and variable fermentation can produce inconsistent results.

The second timing is maceration or infusion after fermentation, before bottling. In this mode, you begin with a finished alcohol base and steep ingredients to extract desirable compounds. This is the classic method for cordials, bitters, many herbal liqueurs, and many infused spirits. It offers control: you can taste over time, remove ingredients when the profile is right, filter the liquid, and stabilize before packaging. Maceration is also where many modern "fruit-infused

wines" live in practice: the winemaker infuses, then removes solids, then bottles. The advantage is stability and repeatability. The disadvantage, if you are chasing tradition, is that it can look less "authentic" because the visible token is gone. That tension—control versus token—drives a lot of modern product decisions.

The third timing is in-bottle inclusion: putting the object in the bottle and sealing it with the liquid around it. This is the most dramatic and the most fragile. If you add whole fruit to bottled wine, you have introduced potential fermentables and microbes into a sealed environment. If the beverage is not truly stable—dry, properly sulfited or otherwise stabilized, and ideally filtered—you can get refermentation, gas buildup, haze, off-flavors, or even dangerous pressure. In spirits above a certain proof, the microbial hazard drops sharply, which is why novelty inclusions are more common in hard liquor than in wine. In-bottle inclusion is often more about narrative than chemistry. It is the purest "object as witness" form.

These categories matter because they separate "added for flavor" from "added for display," and they clarify why certain combinations appear in certain alcohol types. Wine is microbially alive and chemically reactive at modest alcohol levels; spirits are comparatively inert. So fruit in wine is a stability gamble; fruit in vodka is mostly an aesthetic and flavor infusion decision. A worm in mezcal is largely a story object because the base spirit can preserve it; the same worm in a lower-alcohol drink would be a different proposition entirely.

By distinguishing fermentation additions, post-fermentation macerations, and in-bottle inclusions, we get a clean framework that will let the rest of the paper move across epochs without confusion. It also provides a practical bridge: readers who are curious about experimentation can see immediately which mode increases risk, which mode increases control, and which mode is mostly about display.

In the next section, we will formalize this vocabulary into a taxonomy that can handle everything from resin wines and herbal medicinals to modern "bug bottles," without collapsing them into a single category of oddity.

2. Terminology and Taxonomy

If "weird combinations" are a constant, then confusion about what we are looking at is also a constant. Modern discussion often collapses every example into a single mental bucket: "something floating in alcohol." That collapse hides the most important differences: when the addition was made, what chemical or microbial work it was meant to do, whether the object is there for the liquid or for the viewer, and what category of beverage is being produced in the eyes of law and commerce.

This section builds a small taxonomy that keeps the rest of the paper from drifting into folklore-only language. The taxonomy is intentionally practical: it is designed so a reader can look at a bottle, a recipe, or a historical description and place it into a clean set of categories. The value of clean categories is not pedantry; it is that the categories predict outcomes. They predict stability risks, predict what kinds of flavors you can plausibly expect, predict which claims are historically grounded, and predict why producers and consumers keep repeating the practice.

A useful taxonomy for this topic needs to handle at least four axes: (i) process timing (fermentation, post-fermentation, in-bottle), (ii) visibility (token versus dissolved), (iii) biological identity (insect, arthropod, animal, plant, resin), and (iv) product class (wine, flavored wine, spirit, liqueur, wine-based beverage). Once these axes are explicit, the discussion stops being "weird" and becomes legible.

2.1 Infusion, maceration, co-fermentation, and bottle inclusion

These terms are often used loosely, but they refer to distinct production moves. The differences matter because each move puts the additive into a different chemical environment and assigns it a different role.

Infusion is the broadest everyday term: it means that an ingredient is steeped in an alcohol base so that soluble compounds migrate into the liquid. The word is used casually for everything from tea to gin, and that casualness is part of the problem. In alcohol contexts, infusion is best treated as an umbrella term that needs to be pinned down by timing and by base type.

Maceration is a more technical version of infusion, emphasizing that solids are soaked and broken down (physically and chemically) as compounds leach out. In practice, maceration is the core technique behind many herbal spirits and liqueurs: botanicals are left in contact with alcohol for hours, days, or weeks, then removed and the liquid is filtered or blended. Maceration implies time, contact, and extraction as the main mechanism. It also implies that the producer can stop the process at a desired point.

Co-fermentation means adding the ingredient during fermentation, so the additive is present while yeast is producing ethanol and CO_2. Co-fermentation yields different results from maceration because the additive is exposed to a changing environment: rising ethanol, falling sugar, shifting acidity, heat generation, and constant CO_2 agitation. Co-fermented additions can integrate more deeply into the beverage, but they are less predictable. This category includes many traditional fruit-and-grape combinations where fruit is added to must, as well as many ancient and household practices where herbs or resins might be introduced early.

Bottle inclusion is the distinct practice of putting a solid object into the final container and sealing it there. Bottle inclusion can happen after infusion or maceration (the liquid is infused elsewhere and an object is added for display), or it can be the infusion method itself (the object

is placed directly in the bottle and extraction continues over time). Bottle inclusion is the most visible and, in wine contexts, usually the least stable. It is also the most purely narrative: it turns the bottle into a display case.

A final term helps complete the map: finishing additions. This is when a producer adds sugar, acids, or aromatics after fermentation not as an infusion but as a correction or a house-style signature. In modern products, finishing additions often sit behind the "mystery" of a flavored beverage: the bottle might show a token object, but the dominant flavor may come from measured concentrates, syrups, or extracts. That does not make the product illegitimate; it simply changes its classification. The taxonomy here is descriptive: it separates traditional extraction processes from modern flavor engineering.

So the first axis is timing and method: co-ferment (ingredient transforms with fermentation), macerate/infuse (ingredient extracts into finished alcohol), finish (ingredient adjusts the profile without needing solids), and include-in-bottle (ingredient remains visible and continues to function as token and sometimes as ongoing extraction source).

2.2 Visible inclusions versus invisible additives (resins, herbs, sugars)

The second axis is visibility: is the additive meant to be seen, or only tasted? This question sounds superficial, but it cuts straight to motive. What is seen is often what is sold.

Visible inclusions are the tokens: the worm, the scorpion, the snake, the berries, the herbs suspended in the bottle. Visibility changes the product's function in the marketplace. A visible inclusion makes the bottle itself part of the experience. It creates proof-of-story, proof-of-origin, proof-of-strength, or proof-of-daring. The buyer does not have to know chemistry; the buyer can see authenticity. Even when the inclusion does add flavor, visibility changes the balance: the object is no longer merely an ingredient; it is a prop with meaning.

Invisible additives are everything that does not remain as an object: resins dissolved into the matrix, botanicals that have been filtered out, sugars blended in as syrups, acids added for balance, extracts and essences introduced for consistency. These additions can be functionally profound and historically ancient. Resin in ancient wine is "invisible" in the sense that it becomes part of the liquid and the container seal; it does not sit there as a specimen. Herbal wines are often invisible because the herbs are removed or disintegrate. Sweetening and acid adjustments are invisible but can dominate the sensory profile.

The temptation is to treat invisible additions as more "legitimate" because they look less theatrical. But the deeper truth is that invisibility is simply a different design choice. In some eras, visibility was impractical: the container or transport required solids to be removed to avoid spoilage, clogging, or off-flavors. In other eras, visibility was avoided to signal refinement. In still

other contexts, visibility was sought because the token served as a guarantee: “this is what we say it is.”

A key practical distinction follows from visibility: visible inclusions tend to be less standardized. Two bottles with whole berries can look different, taste different, and age differently. Invisible additions are easier to measure, repeat, and regulate. This is one reason modern commercial production gravitates toward invisibility for flavor and toward visibility for marketing. Many products quietly combine both: invisible engineering does the flavor work; a visible token does the story work.

In wine especially, the visibility axis carries risk. Whole fruit in wine is visually clear, but it introduces sugar, microbes, and pectin that can destabilize the bottle. So if a producer wants a “fruit in bottle” effect in wine, they either accept instability as part of the product (often meant for quick consumption), or they engineer stability aggressively. By contrast, in higher-proof spirits the microbial risk is lower, so visibility is easier to maintain. The taxonomy predicts which practices thrive in which product classes.

2.3 Insects versus arthropods versus animals: classification matters

A third axis is biological identity. People often say “insect” when they mean “bug,” and “bug” when they mean “anything creepy that isn’t a plant.” That imprecision matters because it obscures both cultural meaning and chemical reality.

Insects, strictly, are six-legged arthropods with three main body segments and usually wings in adult forms. The “worm” in mezcal is not a worm in the everyday sense; it is typically an insect larva (a caterpillar-like stage of a moth). That matters because “worm” implies something else biologically, and the mislabel carries cultural weight: it makes the bottle sound more transgressive or more primitive than it is. Classification clarifies what the tradition actually involves.

Arthropods are the broader group that includes insects but also arachnids (spiders, scorpions) and crustaceans. A scorpion in a bottle is not an insect. A tarantula is not an insect. These are arachnids. Why does that matter? Because the marketing often trades on the label “insect” or “bug” to amplify the shock factor, and because different arthropods carry different cultural associations. An ant can signal culinary tradition; a scorpion can signal danger; a spider can signal taboo; a worm can signal rustic authenticity. The taxonomy here is a taxonomy of meanings as much as of biology.

Animals, in this paper’s usage, refers to larger vertebrates often used in infusion traditions: snakes, lizards, seahorses, and other creatures found in folk-medicinal alcohol preparations. Again, classification matters because it distinguishes novelty from lineage. In some regions, snake-in-alcohol preparations have a medicinal framing that is centuries old; in others, the same

presentation is imported as shock novelty. Without classification, the reader cannot tell whether a bottle is participating in a medical-ritual tradition or merely copying its aesthetic.

There is also a safety-relevance to classification. Different organisms bring different compounds and different risk profiles. But this paper's central point is simpler: classification matters because it prevents category laundering. A producer can call something "traditional insect infusion" while actually using a non-insect token object with no meaningful extraction role, and the consumer cannot evaluate the claim. Precise terms restore the reader's ability to see what is being claimed.

So the biological axis is: plant/resin, insect, arthropod non-insect, animal. Each category comes with different historical patterns and different modern marketing moves. Naming the category is a form of intellectual hygiene.

2.4 "Wine," "flavored wine," and "spirit": why legal labels diverge from folk usage

The fourth axis is product class, and here modern law creates a divergence between what people say and what products legally are. A consumer may call anything "wine" if it looks wine-like, but regulatory definitions often hinge on alcohol percentage, production method, source of fermentable sugars, and the degree of added flavoring.

In everyday folk usage, "wine" can mean any fermented fruit drink. In many legal regimes, "wine" is more narrowly tied to fermented grape products (with specific allowances for fruit wines depending on jurisdiction). When you add fruit, sugar, and flavorings after fermentation, the product may still taste like wine, but legally it might become "flavored wine," "wine-based beverage," "aromatized wine," or another subclass with its own tax and labeling rules. The consumer sees a bottle; the regulator sees a category.

Similarly, "spirit" in folk usage can mean anything strong. In law, it usually means a distilled product or a product that meets a specific distilled alcohol threshold. When a spirit is sweetened and flavored, it may become a liqueur. When wine is mixed with distilled alcohol and botanicals, it may become an aromatized wine or a fortified wine. These categories exist because production method and composition affect taxation, safety, and labeling truthfulness. The important consequence for our topic is that odd additions can push a beverage across boundaries without the consumer noticing.

This is why legal labels diverge from folk language: the law tracks methods and measurable properties; folk language tracks taste, appearance, and story. A bottle with fruit can be "wine" to the drinker but "wine product" to the regulator. A mezcal with a worm can be "mezcal" in conversation but still be subject to specific denomination rules, and some producers avoid certain inclusions precisely because of category constraints. The taxonomy here matters

because it helps the reader understand why certain practices survive more easily in one category than another.

It also explains a modern trend: when regulation tightens around medicinal claims, producers shift toward spectacle and flavor language. They can sell “infused” and “botanical” without making explicit therapeutic promises. That shift does not mean the older medicinal logic vanished; it means it became implicit, living as suggestion rather than as claim. The consumer still perceives “this is good for me,” but the label does not say it.

So the product-class axis is not merely bureaucratic; it shapes the entire ecology of “weird combinations.” It determines which additions are economically attractive, which are legally risky, which can be standardized, and which remain relegated to home practice or informal markets.

By the end of this section, we have a working grid: method/timing, visibility, biological identity, and product class. This grid lets us interpret the historical record without confusion and interpret modern bottles without falling for category laundering. With this vocabulary in place, the paper can move into antiquity and make careful claims about what was functional, what was medicinal, and what was performative—without collapsing them into the same kind of “weird.”

3. Antiquity: The Functional Origins

If modern eyes are drawn to the spectacle of an object in a bottle, antiquity is the opposite: the most important additions were often not theatrical at all. They were practical. Before stainless steel, sterile filtration, laboratory yeast, and controlled storage temperatures, alcoholic drinks lived on the edge of spoilage. They were vulnerable to oxygen exposure, microbial drift, transport heat, and imperfect seals. Under those conditions, adding “something extra” was not a novelty; it was a strategy for keeping value from dissolving into vinegar, haze, or rot.

In this section, “functional origins” does not mean that people in antiquity had a modern biochemical theory. It means that the observable outcomes were strong enough to stabilize a tradition: some additions made stored alcohol last longer, travel better, and taste more consistent across time. What survives in the record is often a blend of folk empiricism and proto-technology. You do not need to know why resin helps; you only need to know that the jar that used it is still drinkable when the jar that didn’t is not.

Functional does not exclude meaning. In many ancient settings, practical practice and ritual practice are entangled. A preservative can be sacred. A medicine can be a luxury. A spice blend

can be a signal of status. But the functional logic gives the earliest spine: alcohol is precious, storage is fragile, and additives can act as protection.

3.1 Resin in wine: preservation-first logic

Resin is one of the clearest examples of an addition that begins as preservation and later becomes taste and identity. Tree resins are sticky, aromatic, and chemically active. They can seal porous container surfaces, slow oxygen ingress, and contribute compounds that resist certain spoilage pathways. In a world where the main wine container might be a ceramic jar or an amphora with variable quality and variable sealing, resin is not a garnish; it is an engineering move.

There are at least three functional roles resin can serve, even when described in non-technical ancient language.

First, resin can support sealing. A jar or amphora needs a closure: a stopper, a plug, a cap of some kind. Resin can be used as a sealant around closures and seams. Even if the resin is not deliberately mixed into the liquid, it can contact the headspace and the wine, slowly dissolving and flavoring the contents. In other words, “resinated wine” can emerge as a side effect of “well-sealed wine.” Over time, the side effect becomes a style.

Second, resin can slow oxidation. Oxygen is a slow destroyer of wine. Without modern inert gas handling and tight closures, oxidation risk is constant. Resinous compounds and the physical barrier of a resin layer can reduce oxygen exposure and alter the oxidative trajectory. A wine that would turn stale and brown might stay fresher longer. Again, people do not need molecular language to perceive the difference.

Third, resin can inhibit or redirect microbial growth. Ancient wine did not live in a sterile state. Yeasts and bacteria were always nearby, and the balance among them determined whether the product remained wine-like or turned into something else. Many resins contain antimicrobial or inhibitory compounds. If the resin suppresses some organisms more than others, it changes the microbial ecology in a direction the producer prefers. The ancient observation is simple: this practice helps the wine stay “good.”

A crucial point for the paper’s larger argument is that resin is “invisible additive” functional technology. It does not need to be seen to do its work. It may leave an aroma signature; it may become a style marker; but it does not need to remain as a specimen object. This is a reminder that antiquity’s “weird additions” often began as mundane tools.

3.2 Herbal and spiced wines: early extraction and dosing instincts

Herbal and spiced wines are another functional lineage that later develops medical and ritual meanings. The first impulse can be as simple as: wine tastes better with certain plants. But taste

is rarely only taste in ancient settings. A plant's flavor profile often correlates with physiological effects: bitterness can signal digestive stimulation, aromatic oils can signal perceived "warming," and astringency can signal mouthfeel that reads as strength or potency. Over time, flavor becomes a proxy for efficacy.

From a functional perspective, herbs and spices can serve several purposes.

They can mask flaws. If a batch of wine has drifted toward oxidation or microbial funk, aromatic additions can render it palatable. This is not necessarily deception; it can be survival. When fermentation and storage are variable, adding botanicals is a way of rescuing value.

They can stabilize perception. Even if the liquid varies, a consistent spice profile can give the drink a house identity. In a household or in a community, the spice blend becomes the signature that makes the drink recognizable across years. That is an early form of standardization at the level of taste.

They can support preservation indirectly. Many herbs and spices contain antimicrobial compounds. While the effect varies enormously by plant and concentration, the ancient observation is that some additions help a drink last. This observation can merge with ritual and medical language, but it has a functional basis: certain plant chemicals change the micro-ecology of the stored beverage.

They can serve as early "dosing." Even before formal pharmacology, people notice that some plant additions produce sensations and perceived benefits. Alcohol, being an extractor and carrier, makes those sensations more consistent. This is the bridge from functional to medicinal. The same herb in water might be weak or unstable; in wine it is preserved and portable.

This is where the paper's taxonomy matters: many herbal and spiced wines are not "bottle inclusion" practices; they are co-fermentation or maceration practices. The botanicals may be removed, or they may disintegrate into invisibility. The point is that antiquity's extraction instincts often operate without an insistence on the visible token. The liquid carries the active principle; the object does not need to remain.

3.3 Container technology and spoilage: why additives made practical sense

To understand why these practices were rational, we have to picture the container world of antiquity. Modern readers are used to glass bottles with tight caps, stainless steel tanks, controlled temperatures, and a supply chain that assumes stable storage. Ancient producers worked with porous ceramics, variable glazes, organic stoppers, pitch, wax, resin, and seals that were "good enough" rather than airtight by modern standards.

Spoilage risks follow directly from that material reality.

Oxygen ingress was frequent. Even a small leak or a permeable closure changes the entire trajectory of a stored beverage. Oxidation dulls aromas and creates stale notes. Once a beverage tastes “off,” it loses value.

Microbial contamination was normal. The question was not whether microbes were present but which ones dominated. Wine can tolerate some drift; it cannot tolerate all drift. Additives that inhibit certain microbes or change acidity and tannin extraction can shift the odds toward stability.

Transport heat was common. Wine traveling by ship or cart experiences temperature swings that accelerate chemical reactions and microbial growth. An additive that makes the liquid more resilient is not a gimmick; it is a shipping technology.

Sediment and clarity mattered differently. In a world without modern filtration, many drinks were expected to throw sediment. But too much haze, ropey texture, or sourness signaled failure. Additives could help stabilize mouthfeel and reduce perceived defect.

So the deeper logic is this: ancient additives are often compensations for a hard environment. They are a response to material constraints. Resin is a sealant and stabilizer. Herbs and spices can act as both flavor architecture and microbial nudging. These are early forms of process control in a low-control world.

This also explains why different regions evolve different additive traditions. The plants available, the container technologies in use, the typical transport distances, and the ambient temperatures all differ. If you live in a hot environment with long transport, you need different stabilization strategies than if you live in a cooler environment with local consumption. The result is not random cultural variation; it is adaptation to constraints.

3.4 From household practice to trade good: standardization pressures in early markets

Once alcohol becomes a traded commodity rather than a purely household product, new pressures appear. Trade demands repeatability. It demands recognizable quality. It demands that a buyer in one port trust the contents of a jar from another region. That trust problem is where standardization begins to push against improvisation.

Household practice is flexible. If the wine tastes a little off, you add more resin or more herbs. If a batch varies, it is acceptable; the household adapts. Trade practice is less forgiving. A merchant cannot sell “this one turned out different.” The buyer expects a category: this style, this strength, this stability.

Additives can become part of that standardization in several ways.

They become signatures. A region's resinated wine, or a household's spice blend, becomes a stable identity marker. A buyer learns to recognize it. The additive becomes not merely functional but also an authenticity cue: it signals origin.

They become quality controls. Additives that stabilize storage make a product more reliable in transit. Reliability is value. Producers who master reliability gain advantage. Over time, practices that increase reliability get selected, preserved, and transmitted.

They become economic levers. Spices, resins, and botanicals can be expensive. If an additive is costly, it can signal wealth and status. The drink becomes both a beverage and a luxury good. That status signaling can reinforce the tradition even if the original function weakens due to improved storage or changing tastes.

They create early regulation-by-reputation. Formal legal regulation may be absent or limited, but reputational regulation exists: if a merchant sells unstable wine, the buyer learns and avoids. Additives that improve stability protect reputation. In this way, functional practice becomes market ethics.

This section sets up a key transition that will matter later. As technology improves and as regulation changes, the functional necessity of many additives decreases, but the symbolic identity they created remains. The additive can migrate from necessity to tradition to marketing token. But in antiquity, the arrow often points the other way: necessity first, then tradition, then identity.

In the next section, we will follow the same thread into the medicinal domain—where alcohol's extraction power becomes a platform for explicit claims about health, potency, and spiritual effect—and where the line between practical practice and metaphysical meaning becomes deliberately porous.

4. Antiquity: Medicinal and Aphrodisiac Preparations

Once alcohol is understood as an extractor and preservative, the next step is almost inevitable: it becomes a medicine cabinet. In antiquity, the boundary between "drink," "drug," and "ritual substance" is often thin. A household beverage can be dosed into a tonic. A tonic can be sanctified as an offering. A sacred preparation can be consumed as a remedy. What modernity separates into pharmacy, cuisine, and liturgy often lived as a single continuum.

This section is not an attempt to validate ancient medical claims by modern standards. It is an attempt to describe the logic that made such claims stable enough to persist. The logic is that

alcohol is a repeatable carrier. It is a medium that holds the active principle, transports it, and delivers it with fewer variables than water infusions or raw plant chewing. People do not need to know molecular pharmacology to notice patterns: “this preparation reliably produces warmth,” “this eases pain,” “this makes one bold,” “this helps sleep,” “this increases desire.” Once such patterns are perceived, traditions form. Once traditions form, authority and ritual attach.

Aphrodisiac preparations deserve special attention because they reveal a durable feature of human behavior: desire attracts both experimentation and fraud. Where the stakes are intimate and the results are ambiguous, stories can travel faster than truth. Alcohol-based preparations thrive in that territory because they produce immediate sensations (warmth, flushing, relaxation, disinhibition) that can be misread as potency even when the underlying active compounds do little. In other words, alcohol is not only a carrier of actives; it is itself a psychoactive that can lend credibility to whatever is mixed into it.

4.1 Alcohol as delivery mechanism for botanicals and animal-derived materials

In antiquity, two practical problems confront any would-be medicinal tradition: how to extract effects from materials, and how to preserve those effects across time. Alcohol addresses both problems.

As a delivery mechanism, alcohol extracts compounds from botanicals that are poorly soluble in water. Aromatic oils, resins, and many bitter and stimulating principles dissolve into ethanol-rich mixtures more readily than into plain water. Even when the base is wine rather than distilled spirit, the alcohol level can be sufficient to pull out meaningful fractions of certain compounds. This is why herbal wines and early cordials become plausible vehicles for consistent effects.

As a preservative medium, alcohol slows degradation. Plant materials rot. Animal materials rot faster. In a sealed vessel with a sufficiently alcoholic liquid, the decay processes can be slowed enough that a preparation remains usable for months rather than days. That difference changes everything. It allows stockpiling. It allows transport. It allows the rise of specialist producers rather than purely local, immediate use.

This delivery logic extends beyond plants into animal-derived materials. Antiquity contains many traditions of infusing alcohol with animal parts or whole animals, whether for symbolic reasons or for perceived therapeutic transfer. The most straightforward interpretation is that people recognized that certain animal substances are “powerful” in the social imagination and tried to capture that power in a drink. The medium that makes this plausible is alcohol: it can hold and carry the “essence” of a material, at least in the phenomenological sense of taste, aroma, and ritual association.

But this is also where the line between functional extraction and symbolic extraction becomes crucial. When a botanical is added for bitterness or aroma and produces a consistent bodily effect, we are closer to pharmacology. When an animal is infused primarily because it represents potency or protection, we are closer to sympathetic magic. Many ancient preparations likely blend the two. A formula might include both an herb with measurable effects and an animal-derived ingredient whose role is symbolic. The combined preparation can be experienced as stronger precisely because it combines physiology and meaning.

Within the paper's taxonomy, medicinal preparations are often macerations or co-fermentations rather than bottle inclusions. The object is not necessarily meant to remain visible. What matters is that the medium captures and transports something thought to be effective. Visibility becomes more common when credibility is at stake: when the maker wants the consumer to believe the ingredient is real, leaving a token can serve as proof. That "tokenization" of ingredients, however, is not unique to modern marketing; it is a plausible ancient credibility move as well.

4.2 Safety and toxicity: when "medicine" becomes hazard

Medicinal alcohol traditions carry a structural risk: the same properties that make alcohol an effective carrier also make it an effective carrier for harm. If an ingredient is toxic, alcohol can extract that toxicity efficiently. If a dose is uncertain, alcohol can turn uncertainty into danger.

Antiquity does not lack awareness of hazard. Many ancient medical traditions contain warnings, dosage discipline, and the recognition that remedies can kill. But the broader cultural environment creates persistent risk factors.

First, measurement is imprecise. Without standardized concentrations and consistent raw materials, one batch can be mild and another potent. Plant chemistry varies by season, soil, and storage conditions. Animal-derived materials vary even more. A preparation that "usually works" can become a preparation that sometimes poisons.

Second, alcohol itself creates confounding. Alcohol produces warmth, sedation, disinhibition, and numbness. These effects can be mistaken for the medicinal action of the additive. As a result, a remedy can feel effective even if the additive contributes little. That subjective "proof" can push doses upward, as people chase stronger sensations under the belief that potency scales with intensity.

Third, the boundary between remedy and recreational use is porous. A medicinal wine can become a pleasure wine. Once it becomes pleasurable, the dosing logic breaks: people consume more than medicinal amounts. Many "medicinal" preparations become hazardous not because the ingredient is inherently lethal at small doses, but because the delivery vehicle is enjoyable and culturally sanctioned.

Aphrodisiac preparations amplify all three risks. Sexual anxiety and desire make people willing to try stronger doses and more dangerous ingredients. In that domain, the credibility economy becomes distorted: dramatic ingredients and dramatic sensations get rewarded. The resulting selection pressure favors preparations that feel powerful, not necessarily those that are safe.

This is where a sober distinction is needed: antiquity's medicinal traditions include both genuine proto-pharmacology and dangerous experimentation. The point is not to mock ancient medicine; the point is to see that alcohol increases both the efficacy and the hazard, because it increases extraction and encourages repeatable delivery.

In the modern period, some of these hazards get regulated, but the underlying logic does not disappear. It often migrates into suggestion, folklore, and boutique products. The ancient hazard story is therefore not a museum piece; it is part of the continuing pattern.

4.3 Social authority: healer knowledge, priestly knowledge, and the credibility problem

Any medicinal system must solve a credibility problem: why should people believe the remedy works, and why should they trust the person selling it? Antiquity solves this in multiple overlapping ways, often by embedding medicine inside social authority structures.

One solution is the healer specialist: the person who has observed outcomes, learned recipes, and holds a craft tradition. This is empirical authority, even if the conceptual frame is not modern science. The healer can claim, "I have seen this work." That claim becomes stronger when it is supported by ritual performance, controlled preparation, and a reputation for discernment.

A second solution is priestly authority: the remedy is tied to sacred knowledge, divine favor, or ritual purity. In that model, credibility is not only about outcomes; it is about alignment. The preparation works because it is properly consecrated, properly timed, properly offered, properly prayed over, or properly connected to the divine order. Whether or not the ingredients have pharmacological effects, the social system grants the priest credibility because the priest is the recognized mediator.

A third solution is social proof: remedies are trusted because respected people use them, because the community repeats the story, or because the preparation is associated with high-status contexts. This is where luxury and medicine overlap. If spices are expensive and rare, a spiced wine can signal access to power. That access itself becomes part of credibility: "this must be effective because it is costly and prestigious."

The credibility problem becomes more acute in the aphrodisiac domain. Outcomes are variable and often private. Placebo effects are strong. Social stigma distorts reporting. Under these

conditions, authority fills the gap. The healer or priest does not merely sell a drink; they sell a narrative of efficacy and a permission structure to believe.

This credibility dynamic also explains why visible tokens become attractive: leaving an ingredient visible is a crude but powerful proof-of-claim. “You see the worm, therefore you believe the story.” “You see the herb, therefore you believe it is not fake.” In a low-literacy environment, the visual object can function as a label. This is not modern marketing invented from nothing; it is an ancient human response to the credibility problem: convert invisible claims into visible evidence, even when the evidence is only loosely connected to efficacy.

4.4 Ritual entanglement: offerings, symbols, and sacred associations

The final dimension is ritual entanglement. In antiquity, alcohol is not only a consumer product; it is a sacred fluid in many settings: offered to deities, poured in libations, used in feasts with ritual significance, and shared in ceremonies that reaffirm social order. When medicinal preparations attach to alcohol, they inherit this ritual domain.

Ritual entanglement can occur in several ways.

First, the remedy can be offered before it is consumed. The act of offering is a way of aligning the preparation with divine favor. It can also function as a social safeguard: a ritual frame discourages careless use, encourages reverence, and limits consumption to proper contexts.

Second, the ingredients themselves can become symbolic. Plants are rarely “just plants” in ancient systems; they are associated with gods, seasons, virtues, or powers. Animal-derived materials can carry even heavier symbolism: strength, fertility, protection, aggression, endurance. When these materials are placed into an alcoholic medium, the drink becomes a symbolic act. The consumer is not merely ingesting chemicals; they are ingesting a story about power transfer.

Third, the preparation can become part of identity formation. Certain communities or priesthoods may maintain proprietary formulas. The formula is not merely a recipe; it is a boundary marker. To drink the preparation is to participate in the group’s cosmology, to accept its authority, or to mark oneself as initiated. Alcohol’s social role as shared drink makes it an ideal vector for such identity work.

Ritual also reinforces continuity. A purely functional preservative practice can be replaced when technology changes. A ritual practice persists because it is embedded in meaning. If resinated wine becomes part of a cultural identity, it survives even when better seals exist. If a medicinal cordial becomes part of a festival or rite, it persists even when modern medicine displaces its original therapeutic role. Ritual is a preservation mechanism for practices as much as resin is a preservation mechanism for wine.

This section completes the ancient picture: alcohol is a solvent and preservative; it becomes a medicine cabinet; medicine becomes entangled with authority; authority becomes entangled with ritual; and ritual preserves the practice across centuries. Later, when we encounter modern novelty bottles, we should not treat them as a clean break from this history. Many novelty products are best understood as ritual residues—commercialized tokens that retain the ancient logic of credibility and symbolic transfer, even when their functional and medicinal roles have been simplified or abandoned.

In the next section, we follow the thread through medieval and early modern continuities, where distillation grows, apothecary traditions professionalize, and alcohol-based preparations become increasingly standardized—while still keeping one foot in symbolism and social proof.

5. The Long Bridge: Medieval and Early Modern Continuities

Between antiquity and the modern novelty bottle lies a long bridge: centuries in which alcohol-based preparations become more systematized without becoming fully "modern." This bridge matters because it explains how functional and medicinal additions survive even as containers improve, trade networks widen, and specialist institutions emerge. It also explains why the symbolic and theatrical dimension never disappears. Instead, it adapts.

The medieval and early modern periods inherit antiquity's core facts: alcohol extracts, alcohol preserves, and alcohol carries meaning. But the context changes. Urban life grows. Specialized crafts thicken. Written recipes proliferate. Authorities (religious, civic, guild) intermittently regulate production. Apothecaries and monasteries become centers of preparation and record-keeping. And, critically, distillation spreads and becomes culturally normal: a higher-proof carrier appears, unlocking a new range of extraction and preservation strategies. With stronger alcohol, infusions become more stable, more concentrated, and more portable, while also becoming easier to brand and commodify.

This bridge is not a straight line toward scientific medicine. It is a braided stream: some preparations become genuinely more effective through improved technique, while others become more elaborate theater for social and economic reasons. The point is continuity. The "weird combination" remains, but it migrates from household improvisation toward institutional practice and commercial identity.

5.1 Apotheken traditions: cordials, bitters, and medicated spirits

A defining feature of this era is the emergence of semi-professional medicinal alcohol culture: apothecaries, monasteries, and specialist makers who treat alcohol not just as drink but as a

base for remedies. In this setting, the medicinal motive acquires infrastructure. Ingredients are sourced, stored, cataloged, blended, and sold with reputational backing.

Cordials, in their historical sense, are not merely sweet liqueurs. They are “heartening” preparations, tonics meant to strengthen, warm, settle, or restore. Sweetness serves multiple roles: it makes bitter medicines tolerable; it signals richness and potency; and it helps preserve certain mixtures. A cordial is often a blend of botanicals plus sugar or honey in an alcohol base. The important continuity is that this is ancient extraction logic brought under artisanal control.

Bitters occupy the opposite sensory pole: bitterness as discipline, bitterness as medicinal signal. Bitter preparations align with a long-standing intuition that bitter plants support digestion, appetite, and resilience. Whether or not every claim holds by modern standards, the practice is technically coherent: alcohol extracts bitter principles effectively; the result is concentrated and stable; and the dose can be measured by drops or small sips. This is a key move toward standardization: medicine becomes portionable.

Medicated spirits are the broad category that includes both. The distillate acts as carrier and preservative. The botanicals act as actives and as symbolic markers. Often the preparation’s perceived efficacy is reinforced by immediate sensory cues: strong aroma, warming burn, bitter bite, or numbing spice. These cues are not accidental; they are part of the credibility economy. A remedy that feels like nothing is easy to dismiss; a remedy that announces itself is easier to believe.

One of the most important developments here is recipe tradition: formulas that can be repeated. Even without modern lab precision, written and transmitted recipes create a kind of proto-pharmacopoeia. The practice becomes less about “what the household has” and more about “what the tradition demands.” That shift is an early form of quality assurance, but it also creates a new avenue for fraud and imitation: once a formula is famous, others will counterfeit it.

So apothecary culture does not eliminate the credibility problem; it reorganizes it. It replaces purely local trust with brand-like trust: the trusted shop, the monastic lineage, the regional reputation. This is one of the deep roots of modern infused-spirit marketing: the bottle carries not just liquid but a claim to lineage.

5.2 Colonial exchange: new plants, new claims, new blends

The early modern period also brings geographic acceleration. As trade networks expand, the medicinal alcohol system is flooded with new botanicals and new myths of efficacy. This is not merely culinary diversification; it is an epistemic event. New plants arrive with reports from far away: “this cures,” “this fortifies,” “this awakens,” “this protects.” Such claims are hard to test quickly, and the social desire for novelty and advantage makes them attractive.

Colonial exchange changes the additive landscape in at least three ways.

First, it expands the ingredient palette. Spices, barks, roots, seeds, and resins travel. The apothecary's shelf becomes global, even if unevenly and exploitatively. Alcohol is the perfect medium for integrating these imports because it can stabilize them and distribute their flavor and perceived effects efficiently.

Second, it expands the claim space. New ingredients are often introduced not as "new flavors" but as "new powers." The novelty itself becomes part of the claim: if it comes from distant lands and costs more, it must be potent. This is the prestige-credibility loop intensified by global trade.

Third, it expands blending culture. Once many ingredients are available, the logic of the compound remedy intensifies: if one botanical is good, then a carefully orchestrated blend is better. Whether this produces real additive pharmacology or primarily produces sensory complexity, it produces an important cultural outcome: the taste of complexity becomes associated with efficacy. A simple drink is ordinary; a layered, aromatic, bitter-sweet drink feels purposeful.

This is also where "medicine" and "luxury" fuse. Many preparations function socially as both: a cordial served after a meal, a spiced spirit shared among elites, a bitters bottle that signals refinement. The pharmacological story justifies the pleasure; the pleasure reinforces the pharmacological story.

The continuity with our core theme is direct. Additives persist because they meet multiple needs at once: they create taste, create perceived effect, create status, and create narrative. Colonial exchange supercharges the narrative dimension: the bottle becomes a map of empire and distance, encoded into flavor.

5.3 The rise of distillation culture: shifting from wine additives to spirit infusions

Distillation is the technical pivot that alters everything while leaving the underlying pattern intact. Once a culture has reliable access to spirits, the "weird combination" logic shifts from wine-centered stabilization toward spirit-centered extraction.

In wine, many additives were partly compensations for fragility. Wine is lower proof, more microbially active, and more sensitive to oxidation and spoilage. Herbs and resins can help, but the system remains delicate. In spirits, the base is more inert. Higher alcohol inhibits microbial growth more strongly. The same botanical infusion that might spoil in wine can remain stable in spirit. The result is a new world of preparations: more concentrated, more shelf-stable, more transportable, and easier to standardize.

This shift has several consequences.

It separates medicinal extraction from fermentation variability. In co-fermented wines, the yeast and the ingredient interact in complex and unpredictable ways. In spirit infusion, the base is fixed; extraction can be timed and controlled. The maker can adopt a more “engineering” posture: choose proof, choose contact time, choose filtration, choose blending.

It encourages the rise of named styles. Distillation supports branding before branding becomes modern: a known regional spirit, a known infused formula, a known monastic or apothecary preparation. Once a style can travel reliably, reputation can spread. The bottle becomes a vector for identity.

It enables the migration of practices from local to commercial. A household can make herbal wine, but the product may not travel well. A producer can make an infused spirit and sell it widely. This commercial scalability feeds back into standardization and into the credibility economy: the more the product can be replicated, the more the consumer expects consistent outcomes, and the more the producer must engineer consistency.

It reshapes the sensory language of potency. In wine, potency is signaled by bitterness, resinous aroma, or spice. In spirits, potency is also signaled by the burn of alcohol itself. That burn becomes part of the pharmacological theater: it feels like medicine. This is not mere deception; it is a real sensation that supports belief. It becomes part of why spirits are such a stable platform for medicinal and aphrodisiac lore.

This is the underlying reason the modern “object in bottle” phenomenon clusters around spirits rather than wines. Spirits tolerate inclusions better. They preserve the token, keep it visually stable, and reduce microbial risk. Distillation culture makes the object-in-bottle feasible at scale.

5.4 The persistence of proof objects: “see it to believe it” as authenticity signaling

Even as techniques become more controlled, the proof-object logic persists. People want evidence that a claim is real. When the claim is about ingredients, potency, or tradition, a visible token is an intuitive form of evidence. This is not merely a marketing trick. It is a recurring human solution to uncertainty.

In apothecary contexts, proof objects can take many forms: whole botanicals visible in a jar, roots and barks displayed on shelves, prepared specimens, labeled containers. The shop itself becomes the proof object: it shows the ingredients, the craft, the seriousness. The consumer sees that the preparation is not imaginary.

In ritual contexts, proof objects can be symbolic tokens: an herb associated with a saint, a plant connected to a festival, a resin tied to sacred incense traditions. The token signals alignment

with a sacred story. The token does not merely prove ingredient identity; it proves membership in a meaning system.

In commercial contexts, proof objects become brand tokens. The most efficient proof is visual and immediate. A clear bottle with a visible object sells a story without requiring literacy or trust in fine print. This is why the modern novelty bottle is not a rupture; it is a refinement of an ancient and medieval pattern: turn invisible claims into visible cues.

But there is a deeper layer. Proof objects often function as a kind of contract. They implicitly say: "We are not hiding what this is." Even when the object is mostly theater, the theater has an ethical dimension: it is an invitation to evaluate. You can see it; you can accept or reject it. In that sense, visible inclusions can be understood as a response to skepticism. They are a way of managing the credibility problem when scientific verification is unavailable and trust is fragile.

This also helps explain why proof objects are especially common in domains where effects are ambiguous: aphrodisiacs, tonics, strength claims, exotic claims. The more uncertainty there is in outcomes, the more valuable it is to provide sensory and visual cues that make the preparation feel real.

So the bridge period teaches a durable lesson: technical improvement does not erase the need for narrative proof. It changes what counts as proof. As distillation and trade improve consistency, the object in the bottle can become less necessary for function and more useful for identity. That shift sets the stage for the modern era, where some inclusions are genuinely tied to tradition and others are primarily brand theater—yet both draw from the same deep human pattern: "I believe what I can see."

In the next section, we bring this continuity into full view by examining the modern "bug in the bottle" cluster: how it formed, what it actually contains, and why spirits became the natural habitat for visible tokens in an industrial marketplace.

6. Modern Era: The "Bug in the Bottle" Cluster

The modern "bug in the bottle" cluster is best understood as a convergence of three older logics under contemporary market conditions: the ancient extraction instinct, the long-standing credibility token, and the modern need for product differentiation in crowded shelves. The result is a family of products where the visible inclusion is not merely an ingredient but a brand device, a dare, and a proof-of-story compressed into one glance.

This cluster is not uniform. Some inclusions are loosely tethered to regional tradition. Others are straightforward novelty. Some aim for flavor and aroma, while others aim for shock, status, or souvenir value. The cluster also exploits an asymmetry created by distillation culture: spirits are

chemically and microbially forgiving enough to allow visible inclusions to survive shipping, storage, and long shelf times. Wine, by contrast, usually punishes in-bottle inclusions with instability. So the modern market's "weird objects" concentrate in hard liquor not because people stopped being imaginative with wine, but because spirits are the more stable theater.

A second defining feature is semantic looseness. The market benefits from consumers not knowing what they are looking at. "Worm," "bug," "insect," "venom," "traditional," "ancient," and "authentic" are words that can be used without precise commitments. A worm can be an insect larva. A scorpion can be sold as an insect. A token can be sold as tradition. The point is not to accuse; it is to describe the ecology: ambiguity increases sales because it increases mystique and reduces the buyer's ability to audit claims.

This section disentangles the cluster into four components: the mezcal worm story, insect-adjacent flavor infusions (especially ants), non-insect inclusions that ride the "bug" aura, and the souvenir economics that bind the whole category together.

6.1 The mezcal worm: what it is, and how it became a story

The mezcal "worm" is the archetype. It is also the best illustration of how a visible token becomes more important than its chemical contribution. Biologically, the "worm" is typically an insect larva associated with agave, not an earthworm in the garden sense. That mismatch between name and organism is not incidental; it is part of the story economy. "Worm" sounds rustic, primal, and transgressive. "Moth larva" sounds like entomology. The folk term wins.

What matters for our purposes is not only what it is, but what role it plays.

In functional terms, the worm is not required for mezcal production. Mezcal does not need a larva to ferment, distill, or stabilize. In flavor terms, a single larva in a finished bottle is unlikely to be the dominant driver of aroma compared to the agave distillate itself. In microbial terms, the spirit is strong enough to preserve the inclusion. This combination—low functional necessity, low flavor necessity, high visual impact, and high preservability—is exactly the profile of a credibility token.

So how does it become a story? The simplest answer is that it solves a marketing problem. Mezcal, especially in modern export markets, competes with many clear or lightly colored spirits. A visible token makes the bottle memorable. It also creates a ritual: the worm becomes an object of conversation, a dare to consume, a proof of "authentic" experience. The drink becomes a story you can tell afterward.

The worm also becomes an authenticity cue. The buyer infers: if something this odd is present, it must be traditional. That inference may be correct in some cases and incorrect in others, but

the point is that the token invites the inference. It turns the bottle into a self-justifying artifact: the inclusion is so unusual that it feels like it must have a deep origin.

Finally, the worm enables a masculinity or bravado script that is extremely stable in alcohol marketing: “Are you tough enough to eat it?” In this script, the token is not an ingredient. It is a test. The consumption of the token becomes a performance of identity, and performance is one of the most durable drivers of repeated purchase in the alcohol world.

So the mezcal worm is the modern template: a preserved object that creates differentiation, ritual, and identity signaling, while leaning on ambiguity about tradition.

6.2 Ants and other insects in or alongside spirits: flavor versus theater

If the worm is the token template, ants are the more interesting bridge between flavor and theater. In some contexts, ants are used because they do contribute a distinctive sensory signature: acidity, citrusy notes, and savory complexity. But the modern market often merges this with the same proof-object logic: the ant becomes both ingredient and certificate.

The ant case illustrates a key taxonomy point: insects can be used in three distinct ways that are often blurred.

First, insects can be used as infusion material. The insects are steeped and then removed, leaving no visible token. This is an “invisible additive” method. If done carefully, it can be a real flavor strategy.

Second, insects can be used as accompaniment rather than inclusion. A salt blend, a rim, or a side garnish can carry insect-derived flavors without altering the bottled product. This protects stability and regulatory classification while retaining the exotic story.

Third, insects can be left in the bottle as a token. In this case, flavor may be secondary or minimal. The token supplies spectacle and authenticity.

The modern market frequently chooses the third option because it is visually efficient. A few insects visible in the bottle do the work of a label. They communicate novelty instantly, even if the liquid’s flavor is primarily driven by other ingredients or even by concentrates. This is where “flavor versus theater” becomes a spectrum rather than a binary. A producer can honestly say “we use ants,” and the consumer can assume “therefore the ants are the main thing,” even when the product’s profile is dominated by the base spirit and other botanicals.

Another modern pattern is the stacking of cues: insects plus spice, insects plus smoke, insects plus citrus. The point is not only taste; it is to create a narrative of complexity and potency. Complexity reads as craft, and craft reads as authenticity. This is the same logic we saw in apothecary bitters, now re-expressed in novelty packaging and boutique branding.

So ants and insect-adjacent products show the cluster's internal diversity. Not everything is pure gimmick. But in most cases, the visible insect is still doing narrative work beyond flavor: it is telling you what kind of person drinks this and what kind of experience you are supposed to have.

6.3 Scorpions, snakes, and other non-insect inclusions: category confusion as marketing fuel

A striking feature of the modern cluster is the casual collapse of biological categories. Scorpions and spiders are not insects. Snakes are not arthropods at all. Yet they are often marketed within the same "bug bottle" aura because the consumer's emotional category is not taxonomy; it is "creepy, dangerous, exotic."

This confusion is not merely ignorance; it is useful. It expands the marketable palette of tokens. Anything that triggers the "risk" or "taboo" response can be placed into a clear spirit and sold as an experience.

Scorpions are the clearest example. The scorpion token leverages danger imagery: venom, sting, toughness, survival. In reality, high-proof alcohol denatures many biological compounds and preserves the specimen. But the buyer does not primarily buy chemistry; the buyer buys the symbolic contract: "this is extreme."

Snakes occupy a different register. In some traditions, snake-infused alcohol is framed as medicinal. In modern novelty markets, it is often framed as daring and exotic. Here, the token also carries deep mythic associations: snakes symbolize potency, renewal, protection, and forbidden knowledge. Those associations do not have to be consciously articulated to work; they operate at the level of cultural reflex. The bottle becomes a talisman.

Category confusion also supports cultural borrowing without accountability. A producer can mimic the aesthetic of medicinal snake preparations while selling a product primarily as novelty. The consumer receives the aura of antiquity and tradition without needing to know whether the practice is local, imported, or invented. This is an example of what we might call tradition theater: a symbolic borrowing that feels ancient because it looks ancient.

The deeper point is that the modern cluster is not truly about insects. It is about visible tokens that compress three messages: "this is exotic," "this is strong," and "this is authentic." Any organism that can carry those messages and survive in alcohol becomes eligible.

6.4 Souvenir economics: novelty packaging and the tourist gaze

The "bug in the bottle" cluster cannot be explained without souvenir economics. Many of these products are purchased not for repeated daily consumption but for display, gifting, and story. The bottle is a souvenir object as much as it is a beverage container. This changes everything.

A souvenir product is optimized for immediate recognition and social transmission. The buyer imagines the moment of showing it to someone else: “Look what I got.” The product’s value is not only in its flavor but in the reactions it provokes. A visible inclusion is the perfect souvenir feature because it is self-explanatory. No tasting note is required.

Souvenir economics also changes consumer risk tolerance. A buyer may accept lower sensory quality if the object value is high. In other words, the drink can be mediocre and still succeed if the bottle is unforgettable. This is not a flaw of consumers; it is a different purchasing motive. The purchase is a story artifact, not a connoisseur’s selection.

The tourist gaze intensifies this. Travelers often seek objects that encode “localness” in a compact form. An unfamiliar ingredient or creature in a local spirit reads as cultural authenticity, even when it is tailored to tourist demand rather than local practice. The token becomes a performance of place. It says, “I went there,” and “I tried something real.”

Souvenir markets also reward exaggeration and simplification. A complex tradition is hard to sell quickly. A worm in a bottle is instantly legible. The tourist does not need to learn mezcal’s regional diversity, roasting methods, and agave varieties; the tourist can buy the worm story. This is how modern novelty can crowd out nuance while still feeding on the aura of tradition.

Finally, souvenir economics creates a feedback loop: once tourists buy the token version, local producers may increase token production because it sells, even if it was not previously central. The market selects for visibility. Over time, visibility becomes mistaken for tradition because it becomes common. This is one reason “how it became a story” is not a purely historical question; it is an economic one. Stories do not merely reflect culture; they are produced by incentives.

This completes the modern cluster analysis. We now have a clear picture: the bug bottle is a descendant of ancient extraction and medieval proof-object logic, reshaped by distillation’s stability and by tourist markets’ hunger for instantly legible authenticity. The next section turns from meaning to mechanics: why professionals avoid many in-bottle inclusions in wine, what actually goes wrong chemically and microbiologically, and how stabilization technologies attempt to keep story from turning into spoilage.

7. Chemistry and Microbiology: Why Professionals Usually Avoid Whole Additions in Bottle

The modern “object in bottle” aesthetic tempts the imagination, especially when the object is edible: berries in red wine, herbs in white wine, citrus slices in liqueur. But professional producers tend to avoid whole additions in the finished bottle, particularly in wine, because the

bottle is not merely a container. It is a controlled environment with expectations: stability, repeatability, safety, shelf life, and a predictable sensory experience across months or years.

The technical reason is simple: a sealed bottle is a small ecosystem. Once you introduce whole biological material into that ecosystem, you reintroduce variability that professionals spend their entire process trying to remove. You add sugars, acids, enzymes, microbes, and solids that evolve over time. Some of that evolution is benign; much of it is not. The result can be refermentation, spoilage aromas, haze, and pressure buildup. Even when nothing catastrophic happens, the product often drifts in a way consumers interpret as "defective."

This is why spirits tolerate inclusions far better than wine. High-proof ethanol is hostile to most microbial life, and the chemical system is more stable. Wine lives closer to biological activity. Its alcohol concentration is often high enough to preserve but not high enough to sterilize, and its residual nutrients can sustain unwanted growth. So "whole fruit in bottle" for wine is not a quaint rustic gesture. It is a stability gamble unless engineered aggressively.

The goal of this section is not to scare the reader away from experimentation. It is to explain, clearly and mechanically, why professionals avoid it—and to show how the most common failure modes map directly onto the taxonomy built earlier: additions that remain visible, additions made late, and additions that carry fermentable sugars are the highest risk.

7.1 Residual sugar and refermentation: pressure, fizz, instability

The most common hard failure is refermentation: fermentation restarting inside the sealed bottle. The trigger can be as obvious as whole fruit containing sugar, or as subtle as a wine that was not fully dry, combined with a microbial population that survived bottling.

To see why this happens, think of fermentation as a triangle: sugar, yeast, and time. A finished dry wine typically tries to remove one corner of that triangle by eliminating fermentable sugar. But if you add whole fruit to the bottle, you may reintroduce sugar directly. If you add fruit that has been damaged (freezing, crushing, slicing), you increase surface area and release sugars more quickly. If any yeast remains viable—either the wine's original yeast or wild yeast introduced on the fruit—fermentation can restart.

In a carboy or tank, fermentation produces CO_2 that can escape. In a sealed bottle, CO_2 cannot escape. Pressure rises. Depending on closure type and bottle strength, several outcomes are possible:

- The wine becomes fizzy when it was intended to be still.
- The cork creeps or leaks.
- The cap bulges.

- Sediment increases as yeast multiplies and then settles.
- In extreme cases, bottles can break or rupture, creating a safety hazard.

Even when the bottle does not explode, refermentation is a quality failure because it changes the product's balance. It can strip fruit aromas, increase acidity perception, and change mouthfeel. It can also produce off-aromas if stressed yeast are present, especially under nutrient-limited conditions typical of finished wine.

Professionals avoid this by ensuring the wine is fully dry (or by controlling residual sugar with sterile filtration and stabilization) and by not introducing new sugar sources after packaging. Whole fruit in bottle violates that rule by definition.

7.2 Wild microbes and spoilage pathways

Whole additions are microbe delivery vehicles. Fruit skins, herbs, and other botanicals carry wild yeast and bacteria. Even if the base wine has been stabilized, adding untreated solids can inoculate the bottle with organisms that are adapted to survive in low oxygen and moderate alcohol.

In wine, the spoilage pathways that matter most include:

- Acetic acid bacteria (associated with vinegar-like notes) when oxygen is available. Even tiny oxygen ingress over time, plus nutrients from fruit, can make the risk worse.
- Film yeasts that form surface layers in headspace and create stale or solvent-like notes.
- Brettanomyces-like spoilage organisms that can produce barnyard, medicinal, or phenolic aromas if they gain traction.
- Lactic acid bacteria that can alter acidity and produce undesirable metabolites under certain conditions.

A key point is that these organisms do not need to produce dramatic spoilage to harm quality. Subtle drift is enough. The wine that was clean and balanced at bottling can develop a dull nose, odd sourness, or a "mousy" or "stale" defect that appears months later. Consumers interpret this as the producer's fault, because the consumer sees only the bottle, not the ecosystem dynamics inside it.

Spirits are more forgiving because higher ethanol levels reduce microbial viability dramatically. But even in spirits, whole additions can still cause issues: cloudiness, unpleasant extraction of bitter compounds, and slow oxidative drift if oxygen and light exposure are present. The microbial hazard is lower; the sensory hazard remains.

So professionals treat “whole additions” as microbial risk multipliers. If they want flavor from fruit or herbs, they usually prefer to extract in a controlled vessel, then remove solids, then package a stable liquid.

7.3 Pectin haze, sediment, and texture drift over time

Even if you avoid refermentation and spoilage, whole fruit creates physical and colloidal problems that consumers often dislike: haze, sludge, and texture drift.

Pectin is the central culprit in many fruit-based haze issues. Many fruits contain pectins that, when extracted, can form persistent hazes that do not settle cleanly. In wine, haze can be interpreted as “natural” by some audiences and “faulty” by others. But professionals selling broadly tend to avoid unpredictable haze because it complicates storage, serving, and customer expectations.

Sediment is another issue. Whole fruit contributes:

- fine particulates (skin fragments, pulp)
- proteins and polysaccharides
- tannins and phenolics that can precipitate unpredictably
- microbial sediment if any fermentation or microbial growth occurred

Some wines are expected to throw sediment with age. But sediment from fruit inclusions is different: it can be messy, sticky, and visually unappealing. It can also clog the pour and create inconsistent serving experiences.

Texture drift is the most subtle problem. Fruit and botanicals can release compounds over time, shifting mouthfeel. The first bottle opened may taste pleasantly fruit-kissed; the same bottle six months later may taste over-extracted, bitter, or oddly thick. Professionals strive for a product that is stable across its intended shelf life. Whole additions move the product into a “living infusion” model where the flavor is time-dependent. That can be charming in a home experiment; it is hard to support commercially.

This is where the narrative appeal of a visible inclusion collides with the consumer expectation of repeatability. If the consumer’s primary reason for purchase is the spectacle, drift may be tolerated. If the consumer expects a consistent wine, drift becomes complaint.

7.4 Stabilization methods and their tradeoffs

Professionals do have tools to reduce risk. But each tool comes with tradeoffs, and some cannot fully eliminate the problems introduced by whole additions.

One broad strategy is chemical stabilization, typically involving sulfur dioxide management (SO2) and, when residual sugar is present, sorbate. The tradeoff is sensory and philosophical: some audiences prefer low-intervention products, and some additives can be perceived as "unnatural" even when they are common and safe. Chemical stabilization can also fail if the microbial load introduced by fruit is high or if the product is stored warm.

Another strategy is sterile filtration. This is one of the most effective ways to prevent refermentation and microbial spoilage, because it physically removes yeast and bacteria. The tradeoff is that filtration can change mouthfeel and aroma, and it can be inconsistent with certain "natural wine" brand identities. Also, sterile filtration protects the liquid at the time of filtration; it does not protect against re-inoculation if you add fruit after filtration. Once you put untreated whole fruit into a sterile-filtered wine, you have undone the point of sterile filtration.

A third strategy is thermal processing (pasteurization or heat treatment), more common in some beverage categories than in fine wine. The tradeoff is that heat can mute aromatics and alter flavor. Again, even if the base liquid is treated, adding fruit afterward can reintroduce problems.

A fourth strategy is proof elevation, which is why inclusions are more common in spirits. Higher ethanol reduces microbial viability and slows many processes. The tradeoff is obvious: you change the beverage category and the intended drinking experience.

The important takeaway is that stabilization methods work best when the system is closed: stabilize the liquid, then keep it closed. Whole additions in bottle reopen the system. They turn packaging into production. That may be acceptable for small-scale craft and fast consumption, but it fights the entire logic of professional bottling.

7.5 Sensory reality: what you gain in flavor versus what you gain in story

This is the honest question a producer must answer: why put the thing in the bottle? Is it for flavor, or is it for story?

If the goal is flavor, there are usually better ways to achieve it than in-bottle inclusion. Controlled infusion or maceration allows you to:

- taste frequently and stop extraction at the right point
- remove solids to prevent continued drift
- clarify and stabilize the final liquid
- reproduce the profile across batches

In-bottle inclusion is a crude extraction method. It is time-dependent, inconsistent, and difficult to standardize. It can extract desirable aroma at first and then over-extract bitterness later. It can add fruitiness but also add vegetal or seed notes. It can soften a spirit but also cloud it. In wine, it can add a bright berry note but also risk refermentation and spoilage.

So the sensory reality is that the in-bottle method is rarely the best flavor method. Its advantage is not control; it is theater. The visible object provides immediate legibility and conversation value. It also provides the psychological flavor of authenticity: people often report that a drink tastes "more real" when they can see an ingredient. This is not necessarily deceit; it is how perception works. Seeing is itself a flavor modifier.

In other words, the major gain from a visible inclusion is often not chemical flavor, but narrative flavor. The bottle becomes a story artifact. For some consumers and contexts, that is exactly the point. But for professionals who must manage shelf life, distribution, and consistent brand quality, the story gain often does not compensate for the technical risk.

This section therefore clarifies the professional avoidance: whole additions in bottle turn a finished product back into an active system. They reintroduce sugar, microbes, colloids, and time-dependent extraction. A producer can do it, but doing it responsibly requires either accepting drift as part of the product or applying heavy stabilization at the cost of some sensory and brand identity attributes.

With the mechanics now visible, we can return to meaning. The next section looks at how culture, identity, and authenticity signaling interact with these technical realities—why proof objects remain attractive even when professionals know the risks, and how buyers and sellers negotiate the trade between chemistry and story.

8. Culture, Meaning, and the Object as Evidence

The technical story explains why whole inclusions are risky. But the cultural story explains why they persist anyway. Human beings do not buy alcohol purely as chemistry. We buy it as identity, as ritual, as story, as memory, as social signal. When a bottle contains an object—worm, ant, scorpion, berry—it becomes more than a liquid. It becomes a claim made physical.

This section treats the object-in-bottle as a semiotic device: a small piece of matter that functions as evidence. It may be evidence of ingredient identity ("there really are ants in this"), evidence of origin ("this is tied to agave"), evidence of potency ("this is extreme"), or evidence of tradition ("this practice is old"). Often the evidence is ambiguous. But ambiguity does not weaken it; ambiguity can strengthen it, because it invites the buyer to complete the story.

The object also functions as a bridge between ancient motives and modern markets. Antiquity used additives for preservation and medicine, and these motives accrued ritual and authority. Modern consumers may no longer treat a worm or scorpion as medicine, but they still treat it as a token of realness, a "proof of claim" in a world saturated with packaging and persuasion. The object becomes a way to escape the suspicion that everything is engineered and fake. It is the tactile equivalent of "show me receipts."

In a sense, the object-in-bottle is an answer to modern skepticism. It is a primitive certificate: you can't easily counterfeit the fact that there is something inside. That certificate is not the same thing as proof of quality, but it is proof of a certain kind of truth: that the producer did something that can be seen. In an era where labels can claim anything, the visible object feels like honesty.

8.1 The inclusion as a credibility token: "this is real" cues

Credibility tokens work because most consumers cannot audit production. We cannot routinely verify fermentation conditions, filtration levels, ingredient sourcing, or microbial stability. The bottle is a black box. In that black box, a visible inclusion becomes a low-cost signal.

The signal operates on several levels at once.

First, it signals ingredient presence. If you can see a worm or berries, you infer that the drink is genuinely connected to that thing. The inference is not always chemically justified—one berry does not necessarily mean "berry wine"—but the cue is strong because it is direct.

Second, it signals effort. Putting something in the bottle looks like a step beyond mass production. It implies handling, selection, and care. Even when the inclusion is factory-inserted, the consumer's perception is that it is less anonymous than a plain bottle.

Third, it signals risk-taking. A producer willing to sell a bottle with a creature inside seems less timid, less sanitized, more "real." This is crucial: risk is often read as authenticity. If a product feels too safe, it can feel too corporate. The inclusion produces the opposite vibe.

Fourth, it signals identity. The inclusion invites the buyer into a role: the adventurous drinker, the insider, the one who brings weird gifts, the one who can tell the best story. This role is part of credibility too, because the consumer wants to believe they are not being fooled. They want to believe they are participating in something genuine, not buying a marketing illusion. The token helps them believe it.

The interesting twist is that credibility tokens do not need to prove what they imply. They only need to be plausible anchors. The token can be real while the implied narrative remains fuzzy. This is the mechanism by which "tradition theater" works: you show a real object and let the consumer assume an old practice. The object becomes the gateway to an imagined lineage.

This is why professional skepticism about flavor contribution often does not matter. The consumer is not buying marginal aroma extraction; they are buying a credibility experience. The object supplies the experience by converting an invisible production story into a visible fact.

8.2 Ritual residue in modern products: how old logic gets repackaged

Many modern inclusions function as ritual residue: they preserve the shape of an older logic even when the original function has faded.

In antiquity, adding resins and herbs could preserve and medicate. In medieval apothecary practice, visible botanicals could certify real ingredients. In those settings, objects and additives were integrated into ritual and authority. Modern novelty bottles inherit the skeleton of this structure:

- There is a special liquid.
- There is a special ingredient.
- The ingredient is presented as potent, rare, or meaningful.
- The consumer is invited to participate in a small rite: observe, open, pour, dare, consume.
- The rite produces a story that can be shared, which reinforces group identity.

The resemblance to ritual is not accidental. Alcohol itself is ritual-friendly: it changes consciousness and binds social groups. Adding a token deepens that ritual capacity. The worm becomes a “final boss” in the bottle. The scorpion becomes an ordeal. The ant becomes a secret ingredient. The berry becomes a romantic or aesthetic flourish.

Notice what has happened: the ancient medical logic is repackaged as experiential logic. The promise is no longer “this heals,” but “this is authentic,” “this is intense,” “this is exotic,” “this is the real thing.” The consumer’s body still plays a role—alcohol still warms, loosens, and heightens sensation—but the framing has shifted from therapy to experience.

Even the way these products are handled resembles small rites. People photograph the inclusion, pass the bottle around, dare someone to eat it, tell origin stories (often half-true), and mark the moment as special. The object creates an event. That is ritual residue: not religion necessarily, but patterned meaning-making.

This repackaging also solves a modern constraint: medical claims are regulated and risky. But ritual-like experiential claims are safe: “adventurous,” “authentic,” “traditional,” “handcrafted.” These words carry the old aura without triggering the modern burden of proof. The object in the bottle is the physical support for that aura.

8.3 Authenticity wars: craft identity versus mass-market mimicry

Once a token signals authenticity, it becomes an arena for conflict. Who gets to claim the tradition? Who gets to sell the symbol? This is the authenticity war: craft identity versus mass-market mimicry.

Craft identity often frames inclusions as part of regional practice or as an honest local flourish. The craft producer wants to say: “We are not doing this as a gimmick. We are carrying something real.” In this framing, the inclusion is not merely a token; it is an index of place, process, and community.

Mass-market mimicry operates differently. It takes the most legible part of the tradition—the visible token—and reproduces it at scale. The token becomes detached from its local context and turned into a commodity sign. This is economically rational: what sells is the instantly recognizable cue. The nuance of region and process is harder to scale and harder to teach.

The conflict is therefore structural. Craft depends on depth; mass-market depends on legibility. Tokens are legible, so they are easy to copy. Once copied, the token’s meaning becomes noisy. The consumer can no longer tell whether the inclusion indicates genuine local lineage or merely a factory line.

This is why some craft producers reject tokens entirely: they fear the token associates them with tourist novelty, diluting their claims about terroir, agave variety, fermentation method, and distillation craft. Others embrace tokens but try to reframe them with contextual storytelling.

The authenticity war also plays out in the “natural” versus “engineered” divide. Some consumers treat visible solids as evidence of low intervention: “they didn’t filter it; it’s real.” But visible solids can also be staged. A bottle can be heavily engineered for stability and still include a token. That is not necessarily dishonest; it is hybrid design. But it complicates the consumer’s inference that “visible equals natural.” In authenticity wars, inference is everything.

The key insight is that authenticity is not a single property; it is a contested social meaning. Tokens are weapons in that contest because they are portable, visible, and emotionally potent. They allow a producer to claim authenticity without requiring the consumer to learn technical distinctions.

8.4 Disgust, fascination, and status: why some buyers seek boundary-testing drinks

The final driver is psychological and social: boundary-testing. Many people are drawn to products that trigger mild disgust or fear precisely because overcoming those feelings confers status. This is not limited to alcohol. It is visible in spicy foods, extreme sports, horror films, and rites of passage. But alcohol amplifies the effect because it is already socially charged.

Disgust and fascination often arrive together. A scorpion in a bottle is repulsive to some and irresistible to others. The same object can trigger both responses in the same person. This mixed emotional charge makes the experience memorable, and memorability is a form of value in social contexts.

Boundary-testing drinks also work as social sorting. Bringing a “worm bottle” to a party signals something about the bringer: adventurous, humorous, unbothered, worldly, maybe slightly transgressive. Consuming the token signals something about the consumer: courage, toughness, willingness to perform. Even refusing can signal identity: refined, skeptical, not easily manipulated. The token becomes a social instrument.

Status enters because not everyone will do it. If the action is rare, it becomes a marker. The drink is not just a drink; it is a test. The test produces a story. The story produces social currency. In this sense, the “bug in bottle” is a narrative generator.

There is also a deeper status layer tied to authenticity desire. In a world where many experiences feel mediated and artificial, consuming something that looks raw and primal can feel like reclaiming reality. The buyer may not consciously think this, but the emotional logic is clear: “this is not sanitized.” The object is proof that the experience is not purely simulated by branding.

Finally, boundary-testing products often survive because they are gifts. They are purchased not for the buyer’s daily palate, but to be given to someone else as a provocation or joke. Gift economies reward objects that are unique, legible, and story-rich. The inclusion supplies all three. This also ties back to souvenir economics: the bottle is as much a display item as a consumable.

This section therefore completes the cultural explanation. Whole inclusions persist not because they are the best way to flavor a beverage, but because they are the best way to compress authenticity cues, ritual residue, and boundary-testing status into a single object. The inclusion is a credibility token and a social device.

With this cultural logic in view, the paper can now turn practical again: if someone wants to experiment at home, how can they do so responsibly without pretending the risks do not exist? The next section offers a framework for risk categories and safer pathways that respect both the chemistry and the human desire for meaning.

9. Home Experimentation: A Responsible Framework

Home experimentation is part of the long history we have been tracing. Before modern industrial beverage production, most “weird combinations” were household practice. The

difference now is not that people suddenly became curious; it is that modern expectations about safety, stability, and shelf life are stricter, and modern supply chains introduce new hazards (unknown sourcing, unknown treatment, unknown microbial load). So the contemporary challenge is to keep the spirit of experimentation while adopting a professional posture toward risk.

A responsible framework does not require lab equipment. It requires a shift in mindset: treat the bottle as a system, treat the ingredient as a variable, and treat time as an active reagent. If you do that, you will stop thinking of inclusions as “cute” and start thinking of them as controlled interventions. That shift alone prevents most problems.

The aim of this section is not to provide a single recipe. It is to provide a method that produces repeatable outcomes and avoids the common failure modes described earlier: refermentation, microbial spoilage, haze drift, and unpleasant over-extraction. The guiding principle is simple: when you want the look of an object-in-bottle, you must decide whether you are prioritizing story or stability, and then design the process accordingly.

9.1 Risk categories: low, medium, high (by alcohol type and additive type)

The safest way to think about home experiments is to classify them by base alcohol and by additive, because those two variables control almost everything else.

Low risk generally means: high-proof base, low-sugar additive, short contact time, and a closed system after finishing. This is why most traditional inclusion novelties live in spirits rather than wines.

Medium risk generally means: moderate-proof base or additions that introduce sugar, acidity shifts, or high microbial load, but with enough control to manage outcomes.

High risk generally means: low to moderate alcohol, significant added sugar in a sealed container, untreated biological material, warm storage, or the expectation of long aging.

A practical risk grid can be described as follows.

By alcohol type:

- High-proof spirits (typically well above wine strength) are lower risk for microbes but still vulnerable to over-extraction, cloudiness, and unpleasant flavors.
- Fortified wines and liqueurs sit in the middle: they are more stable than table wine but still can be destabilized by sugar and solids.

- Table wines and beers are higher risk for in-bottle solids because they remain biologically and chemically active at those alcohol levels and often contain residual nutrients.

By additive type:

- Dried botanicals (properly dried herbs, spices, citrus peel) are generally lower risk than fresh fruit because they add less water, less sugar, and fewer live microbes.
- Fresh herbs are medium risk: they can carry microbes and can introduce vegetal notes quickly.
- Whole fresh fruit is medium to high risk depending on sugar content, skin condition, and whether the final container is sealed for storage.
- Crushed fruit, fruit puree, or anything that exposes juice is higher risk because it releases sugars and nutrients rapidly.
- Animal or insect inclusions are not recommended for casual home practice because sourcing and safety are difficult to audit, and the practice is easy to turn into contamination theater. Even when the microbial risk is reduced in high proof, the ethical and quality-control issues are nontrivial.

Within this grid, the biggest “surprise” risk is sealed storage. Many experiments are safe in an open jar in the fridge for a week and become unsafe when bottled and stored at room temperature for months. The same liquid can shift from low risk to high risk simply by sealing it and leaving it warm.

So the simplest home rule is: sealed plus sugar plus microbes equals trouble. If any two of those are present, you need to redesign.

9.2 Safer paths: infuse then filter, control sugar, control microbes

A responsible framework favors processes that keep the system controllable.

The safest general pattern is: extract flavor under control, remove solids, then package a stable liquid. This is what professionals do because it separates experimentation from storage. The bottle becomes a finished state rather than a continuing experiment.

Infuse then filter is the core technique. You put your base (spirit, wine, or fortified wine) in a separate container with your ingredient, taste over time, stop when you like it, and remove the solids. This prevents the “flavor keeps changing in the bottle” problem. It also allows you to see if haze forms and to decide whether to accept it, settle it, or filter it.

Control sugar is the second pillar. If you want fruit character without sugar risk, you have several safer options:

- Use dried fruit or peel for aroma rather than juice for sweetness.
- Use small amounts of fruit for short contact time, then remove.
- If sweetness is the goal, sweeten deliberately with measured syrup rather than relying on fruit sugars that are unpredictable and microbe-friendly.

A useful discipline is to separate “flavor extraction” from “sweetness design.” Fruit gives both, but it gives both unpredictably. If you want control, design sweetness as its own variable.

Control microbes is the third pillar, and this is where wine requires extra caution. Microbes come from fruit skins, herbs, and your equipment. The most effective home-level control methods are not exotic: cleanliness, cold storage during infusion, short contact times for fresh items, and avoiding sealed long-term storage unless the system is truly stable.

A practical posture is to treat fresh biological material as if it is always carrying microbes, because it is. That assumption prevents complacency. It leads you to choose dried botanicals when possible, to use refrigeration, to avoid sealing active systems, and to consume experiments quickly when uncertainty is present.

Finally, if your goal is the theatrical look of an object in the bottle, the responsible workaround is to treat the object as a display token rather than as an active ingredient. That means: stabilize the liquid first, then add a low-risk token that will not contribute sugar or microbial load. In spirits, dried botanicals or inert objects (food-safe) can serve that role. In wine, this is still tricky, but if attempted, it should be treated as “drink soon,” not “age on the shelf.”

9.3 When not to do it: vulnerable storage, unknown sourcing, long aging expectations

A responsible framework must include refusal rules: conditions under which you simply should not do the experiment.

Do not do sealed-bottle whole additions when you cannot control storage temperature. Warm storage accelerates everything: microbial growth, refermentation, extraction drift, oxidation. If you cannot guarantee cool, stable conditions, do not seal an active system.

Do not do whole fruit additions in table wine if you expect the bottle to sit for months. Whole fruit in wine is almost always a “consume soon” practice unless you have stabilization tools and experience. The mismatch between “cute bottle” and “long shelf life” is where hazards concentrate.

Do not do experiments with unknown sourcing when the additive is biologically complex. Random insects, random animal-derived materials, or questionable dried items can carry contaminants or residues you cannot evaluate. The home experimenter's strength is creativity; it is not supply-chain verification. If you cannot audit sourcing, choose safer ingredients.

Do not do experiments that rely on long aging expectations. People often imagine that "more time equals better." For many infusions, more time equals over-extraction, bitterness, vegetal drift, and haze. If you want aging, do it with a stable base and without active solids in the bottle.

Do not do experiments if you are relying on "I'll see if it bubbles" as your safety check. By the time you see pressure, you have already created instability. The framework should prevent you from getting there.

These refusal rules are not moral restrictions; they are engineering constraints. They exist to keep a fun curiosity from turning into waste, disappointment, or danger.

9.4 Documentation and repeatability: turning "weird" into method instead of accident

The difference between "weird" as a gimmick and "weird" as a craft is documentation. If you want experimentation to produce learning rather than random outcomes, you must record what you did.

A minimal home log converts novelty into method:

- Base: what beverage, what proof or ABV, what brand or batch
- Additive: what ingredient, fresh or dried, approximate weight or count
- Process timing: infusion, maceration, co-fermentation, or bottle inclusion
- Contact time: how long the ingredient was in the liquid
- Temperature: room temperature versus refrigerated
- Filtration: none, coarse, fine
- Sweetness changes: added sugar or not, and how much
- Sensory notes: smell, taste, mouthfeel at time points
- Outcome: stable, hazy, fizzy, off-notes, drift

Even crude notes are enough. The key is to create repeatable control variables. Without notes, every success is an accident and every failure is a mystery. With notes, you can iterate: reduce contact time, switch fresh to dried, change base proof, change sweetness design, change filtration.

Documentation also supports honesty. Many people tell themselves, “this is traditional” when what they really mean is “this is fun.” A log forces clarity. It reveals whether the token is doing flavor work or story work. It reveals whether the process is stable or a gamble. It turns folklore into craft.

Finally, documentation is a form of respect for the long historical arc we traced. The entire trajectory from antiquity to apothecary culture to modern infusions is a trajectory of increasing control and repeatability. Home experimentation can participate in that arc by adopting the apothecary posture: careful, recorded, and disciplined—without losing the playful spirit that makes “weird combinations” human in the first place.

With this framework in place, the paper can move toward synthesis and conclusion: the central argument that alcohol-plus-addition is not a modern gimmick but a persistent human pattern, reshaped by technology and markets, and now available to anyone—provided they treat the bottle as a system and the object as both ingredient and evidence.

10. Conclusion: A Single Pattern with Three Faces

The question that began this paper—“Has anyone ever bottled wine with whole fruit added, like blueberries in red wine, and what insects are added to hard liquor?”—looks at first like a catalog request. It invites a list of oddities. But the deeper coherence becomes visible once we follow the practice back through time. “Weird combinations” are not a modern eccentricity. They are a stable human pattern that reappears whenever alcohol is present, because alcohol is uniquely suited to be both a chemical medium and a narrative medium.

Across antiquity, the medieval and early modern bridge, and the modern tourist-and-brand economy, the same structural triangle keeps reforming:

- Alcohol is an extraction platform.
- Additives are either functional, medicinal, or symbolic.
- The container becomes a carrier of meaning as much as of liquid.

The surprising result is that the practice is not three unrelated trends (“preservation tricks,” “folk medicine,” “marketing gimmicks”). It is one pattern with three faces. The face that dominates depends on constraints: container tech, microbial control, regulatory limits, trade networks, and what the buyer wants to feel when they buy a bottle.

This conclusion closes the argument by restating the thesis, specifying what has changed, specifying what persists, and pointing to forward work that can keep the paper honest: a

disciplined Reference section and a comparative case-table appendix that makes the taxonomy operational.

10.1 Thesis restated: preservation, pharmacopeia, and performance are the recurring drivers

The thesis is that additive practices in alcohol are repeatedly driven by three motives that can coexist but usually have a dominant mode in a given era: preservation, pharmacopeia, and performance.

Preservation is the earliest driver in the historical arc we traced. When storage is porous and transport is harsh, additives make sense as stabilizers and sealants. Resin and certain botanicals are not “weird”; they are low-tech process control. They are engineering solutions in a world without modern closures, sterile filtration, or controlled temperatures. In this mode, the additive is primarily justified by survival: keep the product from failing.

Pharmacopeia emerges naturally from preservation because the same properties that stabilize a beverage also enable medicine: extraction and transport of actives. Once alcohol is seen to preserve and carry plant compounds, it becomes a delivery mechanism for botanicals and, in some traditions, animal-derived symbolic materials. This mode organizes itself around authority: healer knowledge, priestly knowledge, apothecary craft, and the credibility structures that make people trust a remedy.

Performance becomes dominant when preservation is less necessary and medical claims become constrained or socially reinterpreted. In this mode, the inclusion persists primarily as a token: it is evidence, story, dare, souvenir, and identity marker. The “bug in bottle” cluster is the modern emblem of this mode. The object is no longer required for function, and it is not typically consumed as medicine; it is a prop that generates social value.

These three faces are not mutually exclusive. Modern products sometimes borrow medicinal aura while selling performance. Ancient products sometimes served as offerings while solving preservation. But the recurring drivers are stable enough that the taxonomy can predict behavior: if the additive does not contribute preservation and is not framed as medicine, it is likely doing performance work; if it is doing medicine work, it will tend to recruit authority and ritual; if it is doing preservation work, it will tend to become invisible or dissolve into style once containers improve.

10.2 What changes: technology, markets, regulation, and branding

If the motives persist, why do the products look so different across time? Because the constraint environment changes.

Technology is the most obvious axis of change. Improvements in containers, closures, sanitation, temperature control, and filtration reduce the need for many functional additives. Distillation

introduces a higher-proof base that is more stable, altering what inclusions are feasible and what extraction profiles are possible. Modern packaging also changes what can be marketed: clear glass, shelf-stable products, and large-scale distribution make the visible token an economically viable design choice.

Markets change the selection pressure. Household improvisation does not need strict repeatability. Trade goods do. Once a beverage moves into commerce, stability and reproducibility become economically valuable. Later, as shelves crowd with competing brands, differentiation becomes valuable, and visible inclusions become one of the fastest ways to differentiate without requiring consumer education. Souvenir markets amplify this: the bottle becomes a story artifact rather than merely a consumable.

Regulation changes what can be said and what must be proven. When medicinal claims are legally risky, products migrate toward suggestion and experience language. When category definitions matter for taxation and labeling, producers shape their formulations to fit or to exploit boundaries: wine versus flavored wine, spirit versus liqueur, infusion versus additive. Regulation also shapes stabilization decisions: producers choose processes that satisfy safety and shelf-life expectations while remaining within brand identity constraints.

Branding is the modern translation layer for older authority. Apothecary trust becomes brand trust. Priesthood lineage becomes heritage marketing. The object in the bottle becomes a logo you can see. Branding does not invent the credibility problem; it institutionalizes it. It makes credibility scalable, but often at the cost of nuance. A token is legible. Nuance is slow. Modern branding rewards legible signals, which is why category confusion (worm versus larva, insect versus arachnid) can persist: precision is not the primary economic virtue.

So what changes is not human curiosity but the ecosystem of constraints. The same human desire to preserve, heal, and perform finds new forms when technology, markets, and regulation shift.

10.3 What persists: alcohol as extraction medium and meaning medium

What persists is alcohol itself as a dual-purpose medium.

Chemically, alcohol remains a uniquely flexible solvent. It extracts aromatic oils, resins, bitters, and many plant compounds more effectively than water alone. It preserves those extracts and stabilizes them in ways that allow storage and transport. This is why the basic move—add plant or creature to alcohol, wait, and taste—keeps reappearing. It is technically intuitive and historically validated.

Culturally, alcohol remains a meaning amplifier. It is embedded in hospitality, bonding, taboo, celebration, grief, ritual, and identity. Because alcohol is already socially charged, additions

become symbolically charged. An herb is not just an herb; it can become a sign of medicine, tradition, or localness. A bug is not just a bug; it becomes a dare, a certificate, a performance, a souvenir, and an authenticity token. The chemical and cultural functions reinforce each other: extraction creates sensory novelty, and sensory novelty creates narrative energy.

This dual role explains why "whole fruit in wine" is alluring even when technically risky. The fruit promises not only flavor but a visible proof of craft and a romantic aesthetic. The same logic explains why the mezcal worm persists: it gives a physical anchor for a story and a social ritual, regardless of how little it matters chemically.

It also explains why professionals and home experimenters differ. Professionals are accountable to shelf life and consistency; they therefore prefer extraction without visible ongoing drift. Home experimenters are accountable primarily to experience; they can accept time-dependent change and drink quickly. The difference is not virtue; it is incentive structure.

So the paper's final claim is that alcohol's persistence as both solvent and symbol guarantees that "weird combinations" will never disappear. They will simply migrate to whatever forms best fit the current constraint environment.

10.4 Forward work: a disciplined Reference section and a comparative case-table appendix

The paper now has two clear forward tasks that can strengthen it without changing its voice.

First is a disciplined Reference section. Because the topic blends tradition, marketing narratives, and technical stability, references should be handled with care. They should distinguish between primary historical sources, ethnographic or cultural analyses, modern regulatory definitions, and technical wine and spirit stability references. The goal is not to overwhelm the reader with citations but to make the claims auditable—especially where popular folklore diverges from documented practice.

Second is a comparative case-table appendix that operationalizes the taxonomy. A well-designed table can let the reader see, at a glance, how cases differ along the axes we introduced:

- Base type (wine, fortified wine, spirit, liqueur)
- Addition timing (co-fermentation, maceration, finishing, in-bottle)
- Visibility (token versus filtered)
- Additive class (resin, botanical, fruit, insect, arthropod, animal)
- Primary motive (preservation, pharmacopeia, performance)
- Stability risk (low, medium, high)

- Typical market context (household, apothecary, craft, tourist, mass market)

Such a table would allow the paper to hold both the chemistry and the meaning in one frame. It would also prevent the reader from collapsing everything into “weird.” The entire argument of the paper is that these are not random curiosities. They are variations on a stable human pattern that becomes legible once we name the drivers and the constraints.

With that, the arc is complete: from “weird combinations” as an intuition, to antiquity’s functional logic, to the medicinal and ritual continuum, to distillation and apothecary continuity, to the modern bug-bottle cluster, to the professional reasons for avoiding whole inclusions, to the cultural reasons for seeking them anyway, and finally to a responsible method for home experimentation. The paper’s core contribution is not a list of odd bottles; it is a grammar for understanding why such bottles exist—and why they will continue to exist as long as alcohol remains both solvent and symbol.

References

Kawahara, A. Y., et al. (2023). “Mezcal worm in a bottle: DNA evidence suggests a single …” (peer-reviewed article). PubMed Central (PMC). PMC

Florida Museum of Natural History (2023-03-08). “Scientists uncover the unexpected identity of mezcal worms.” floridamuseum.ufl.edu

Imbibe Magazine (2020-04-22). “Sal De Gusano: The Perfect Companion to Mezcal.” Imbibe Magazine

Food & Wine (article excerpt in search results). “It’s Time to Get Into Worm Salt.” Food & Wine

Masienda (product/ingredient background). “Worm Salt” (Sal de gusano explainer). Masienda

Masienda (product/ingredient background). “Chicatana Ants” (seasonality, culinary use, pairing with mezcal). Masienda

Wines of Greece (Greek Wine Federation site). “Retsina” (process description; resin added during fermentation and removed). Wines of Greece

Zareva, S., et al. (2010). “The application of the derivative IR-spectroscopy and …” (on retsina origins/transport amphorae sealing). ScienceDirect. ScienceDirect

Wine & Culture & Society (2018-06-26). “Retsina” (historical amphora pitch/resin discussion; interpretive cautions). Wine, Culture & Society

Columella. *De Re Rustica* (Loeb Classical Library translation hosted online). LacusCurtius / University of Chicago (public-domain text reproduction). Penelope

Wikipedia (reference overviews and leads to primary/secondary sources). “Retsina.” Wikipedia

Wikipedia (reference overview and leads). “Hippocras.” Wikipedia

Wikipedia (reference overview and leads). “Snake wine.” Wikipedia

Atlas Obscura (food/culture reference). “Snake Wine” (TCM framing; ethanol denaturation claim; cultural context). Atlas Obscura

Natural History Magazine (perspective piece). “Snake Oil Redux” (risk notes; adulteration hazards; scorpions/herbs sometimes added). naturalhistorymag.com

Folger Shakespeare Library (2024-10-07). “Alchemy, aqua vitae, and Mixology: How alchemy gave us liquor.” Folger Shakespeare Library

Difford’s Guide (encyclopedia entry). “The life and times of aqua vitae.” Difford's Guide

Wikipedia (reference overview and leads). “Aqua vitae.” Wikipedia

InsideHook (2022-05-05). “Uncovering the Reason Behind the Mexican Mezcal Worm” (media history/claims; folklore vs marketing discussion). InsideHook

Mezcalistas (2020-01-14). “Mezcal really is the new mezcal: Revisiting the recent history of mezcal” (industry history context). Mezcalistas

Australian Wine Research Institute (AWRI). “Chemical options for microbiological stabilisation” (sterile filtration guidance; yeast control). The Australian Wine Research Institute

Iowa State University Extension (2021-02-15). “Considerations for use of Sorbic acid in sweet wines.” Iowa State University Extension

Iowa State University Extension (2022-01-28). “Using Potassium Sorbate to Inhibit Yeast Growth in Bottled Wines.” Iowa State University Extension

University of Minnesota Enology (bottling guidance). “Practical preparation techniques for wine bottling.” enology.umn.edu

Winemaker Magazine. “Bottling, Start to Finish” (home/small producer bottling stability; sorbate + SO2 discussion). WineMakerMag.com

Winemaker Magazine. “Using Pectic Enzymes” (pectin breakdown timing; haze mitigation). WineMakerMag.com

eCFR (U.S. Electronic Code of Federal Regulations). 27 CFR Part 24, Subpart H: “Production of Special Natural Wine” (definition and scope of flavored/special natural wines). eCFR

Cornell Law School (Legal Information Institute). 27 CFR § 24.10 “Meaning of terms” (special natural wine definition reference). Legal Information Institute

TTB (Alcohol and Tobacco Tax and Trade Bureau). “Which Alcohol Beverages Require Formula Approval?” (when treatments/materials trigger formula requirements). TTB

TTB / ATF (historical regulatory document PDF). “Labeling of Flavored Wine Products (98R-317P)” (consumer confusion rationale; flavored wine identity). TTB

TrendHunter (2009-02-18). “Alcohol-Infused Insects: The Scorpion in the Skorppio bottle …” (modern novelty/marketing example). TrendHunter.com

Thailand Unique / novelty spirits listing. “Scorpion Vodka Mezcal Infusion 60ml” (example of scorpion inclusion as collectible/novelty). thailandunique.com

The author has published over 4,700 AI-assisted papers at: https://www.researchgate.net/profile/Douglas-Youvan/research . Google Scholar has indexed these preprints, and if you want a particular reference, the AI mode of a Google search (Gemini) has efficiently catalogued these preprints.